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(54) DEVICE FOR RECORDING MAGNETIC BUBBLE DOMAINS IN MEMORY BANKS

This invention falls into the field of computer engineering and automation.

A magnetostrictive-piezcoelectric device already exists for recording magnetic bubble domains (MBDs), which contains plates made from magnetostrictive and piezoelectric materials that are arranged on a magnetically uniaxial plate with a MBD [1]. A magnetoresistive device also already exists for recording MBDs, which contains a sensor in the form of a thin-film ferromagnetic application and a thick-film chevron application [2].

These existing devices have fairly low reliability.

The closest engineering solution consists of an acoustic device for recording MBDs that contains a magnetically uniaxial plate with a domain propagation channel, on the surface of which a piezoelectric plate is positioned, on which a surface acoustic wave (SAW) receiver and absorber are arranged in tandem, together with an SAW radiator, the outputs of which are connected to a power source, while the outputs of the surface acoustic wave receiver are connected to the input of an amplifier [3].

This existing device has low reliability due to the use of a set of magnetostrictive plates and insulated conductors on its surface as the SAW receiver, which necessitates the creation of an insulating layer between the conductors and this plate.

The purpose of the invention at hand consists of the enhancement of device reliability.

This purpose is achieved by virtue of the fact that the device contains a magnetostrictive plate that is positioned on the surface of a piezoelectric plate between the SAW radiator and receiver.

The device (a top view) is depicted in Fig. 1; a cross-section of the part of the device situated on a magnetically uniaxial plate is shown in Fig. 2.

This device contains a magnetically uniaxial plate, 1, with a domain propagation channel, 2, that is tentatively designated by a broken straight line.

On the surface of plate 1, a piezoelectric plate in positioned, in the capacity of which, for example, an evaporated lithium niobate film is used.

On piezoelectric plate 3, an SAW radiator, 4, is positioned that consists, for instance, of metal electrodes with a plicated design, which are located on one side of plate 3. Conductors, 5 and 6, connect radiator 4 to the radiator power source, 7. Power source 7 contains a generator of the alternating-current electric voltage that is supplied to the radiator electrodes.

Above a selected section of MBD propagation channel 2, on piezoelectric plate 3, a magnetostrictive plate, 8, is positioned, for example, made from permalloy. The ferromagnetic element through the use of which MBD propagation channel 2 is formed can serve as this plate. A SAW receiver, 9, is situated on plate 3, which consists of two electrodes fashioned in the form of metal plates with a plicated shape, positioned on one side of plate 3 and connected by means of conductors, 10 and 11, to the input of an output signal amplifier, 12. Radiator 4 and receiver 9 are arranged along the same straight line as magnetostrictive plate 8, on opposite sides of it. Thus, their position and orientation are such that magnetostrictive plate 8 and receiver 9 lie in tandem along the SAW travel path from radiator 4. The parameters of SAW radiator 4 and receiver 9 are matched with their frequency. On piezoelectric plate 3, an SAW absorber, 13, is situated, made from a material with a high SAW attenuation coefficient. Absorber 13 is positioned on a straight line with plate 8 and receiver 9; i.e., along the SAW travel path that successively passes plate 8 and receiver 9, and serves to absorb a wave of this type for the purpose of preventing its secondary parasitic influence (for example, due to reflection from the edges of plate 3) on receiver 9.

Not only piezoelectrics, but also other materials that are good acoustic ducts, can be used as the SAW waveguide, while a plate made from a magnetically uniaxial material that has magnetostrictive properties can itself serve as the magnetostrictive plate.

The device operates in the following manner.

The alternating-current voltage excited by the SAW in plate 3, which is used as the waveguide, is fed from power source 7 through conductors 5 and 6 to SAW radiator 4. The waves travel from SAW radiator 4 along plate 3, pass through MBD propagation channel 2 under magnetostrictive plate 3 and proceed to receiver 9. In traveling along piezoelectric plate 3, the SAWs give rise to the appearance of electric potentials that are variable in time and space – on the surface of plate 3, since piezoelectrics are good electromechanical transducers. When the SAWs pass through the area when the receiver is located, these variable potentials excite alternating-current electric voltage on electrodes 9, which output signal amplifier 12 captures by means of conductors 11 and 12. SAW transmission along the piezoelectrics is largely dependent upon the presence of

distribution of mechanical stresses in waveguide piezoelectric plate 3 along the travel path of these waves. This property is due to the high electromechanical properties of piezoelectrics and is used in the present invention in the following manner. As the MBD indicated by item number 14 passes along MBD propagation channel 2, there is an MBD stray field under magnetostrictive plate 8 that alters plate 8's magnetization intensity and causes its deformation. The deformation of plate 8 gives rise to strain and the appearance of mechanical stresses in the area of piezoelectric plate 3 along the SAW travel path from radiator 4. This waveguide property variation brings about a change in wave amplitude properties, frequency content, and transmission speed. Thus, the different alternating-current electric voltage and signal phase at the output of receiver 9 corresponds to the presence or absence of the MBD being recorded, which output signal amplifier 12 also captures. The SAWs generated by radiator 4, in successively traversing magnetostrictive plate 8 and receiver 9, dampens absorber 13, which increase the signal-noise ratio.

Patent Claims

This device for recording magnetic bubble domains in memory banks, which contains a magnetically uniaxial plate with a domain propagation channel, on the surface of which a piezoelectric plate is positioned, on which a surface acoustic wave receiver and absorber are arranged in tandem, together with a surface acoustic wave radiator, the outputs of which are connected to a power source, while the surface acoustic wave receiver outputs are connected to an amplifier input, is distinctive in that, for the purpose of enhancing device reliability, it contains a magnetostrictive plate that is situated on the surface of the piezoelectric plate between the surface acoustic wave radiator and receiver.

Information sources taken into consideration during the examination:

1. *"Magnetostrictive-Piezoelectric Bubble Detectors". W. Ishak, et al. 20th Cmmm*[1], *American Institute of Physics (AIP) Conference Proceedings, Vol. 24, pp. 558-559.*

2. United States (US) Patent No. 3702995, Classification (Cl.) 340-174, 1971.

3. *"Acoustic Bubble Detector". W. Kinsner and E. Della Torre. Abstracts of the Conference on Computer Hardware and Systems. Palo Alto, Calif., USA, December 1974, pp. 53-54.*

[1] **Translator's Note**: Despite an extensive search, no relevant definition could be found for the abbreviation "Cmmm".

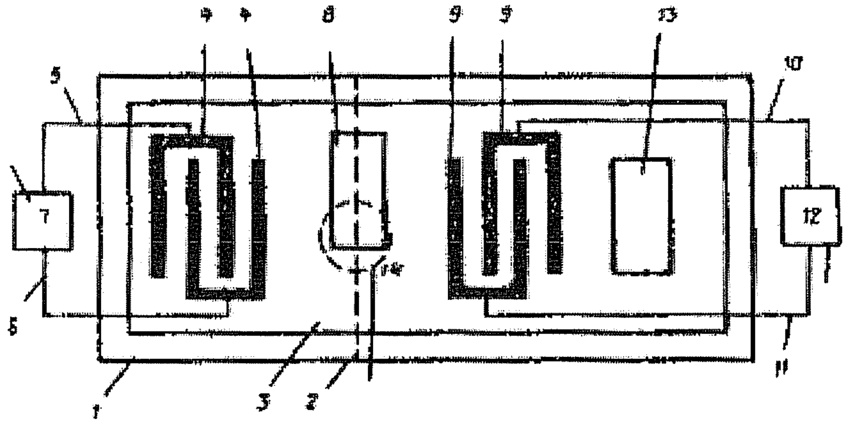

Fig. 1

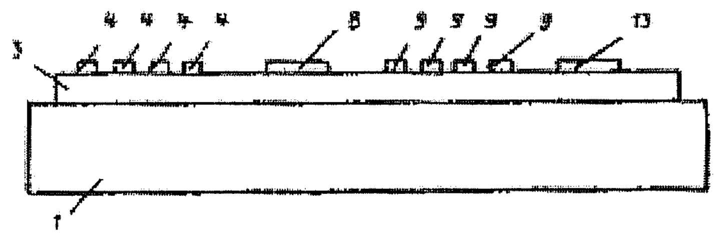

Fig. 2

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